Instruction Manual

Analyser Reference System

Type ARS 16/1

Serial No.: UO467 07/0 0613

The manufacturer can not be held liable for incorrect statements and their consequences; subject to change !

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1. General Instructions

This device has been shipped in perfect safety condition. However, it has to be checked for mechanical defects before the first start-up. If there is any transportation damage the device must not be put into operation. Spitzenberger & Spies has to be informed immediately.

Important Reference: **The devices/racks must only be moved/transported in upright position! Exceptions are only permissible after consultation with the manufacturer! The customer is liable for defects caused by disregarding this regulation.**

2. Connection

Before connecting the device please make sure that the line voltage and frequency correspond with the device's. Note that the protected earthing conductor has to be connected according to regulations. The earthing resistance has to meet the relevant safety regulations. Insufficient connection of the protected earthing conductor might cause malfunctions of the system. We recommend to supply the system via fault-current circuit breaker.

Mains voltage	230V (+6% -10%)
Mains frequency	50Hz/60Hz
Mains protection	2A
Releasing characteristics (recommended)	C or D
Fault-current circuit breaker (recommended)	≥ 30mA
Mains plug	Earthing contact socket 16A

When controlling the system via PC the latter should be supplied by a common mains.

To make sure that the device works faultlessly and no overheating occurs, sufficient ventilation and enough distance from the device's rear side to any wall has to be guaranteed (60cm recommended).

3. Safety

The device must only be operated by instructed personnel !

Energized parts might be uncovered when opening the housing. Before opening the device the mains input cable has to be disconnected from the supply voltage due to safety regulations. The chassis ground of the device is connected to earth.

Warning: **Capacitors still can be charged even when the device is disconnected from all voltage sources.**

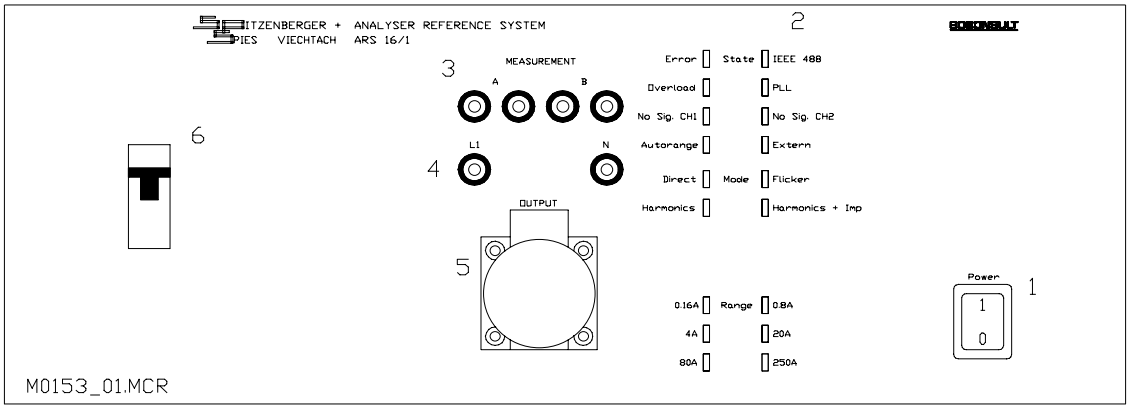
Keep a three-minute waiting period before opening the device after having disconnected the device from each voltage sources (power supplies).

The device output is not electrically isolated from the mains. There is no protection by electrical separation according to the relevant VDE regulations.

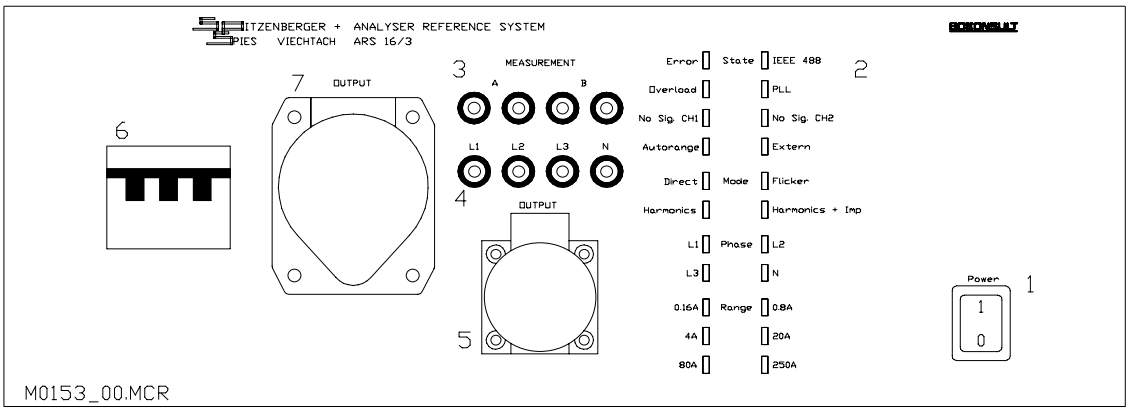
4. Analyser Reference System ARS 16

4.1. Front Panel

ARS 16/1



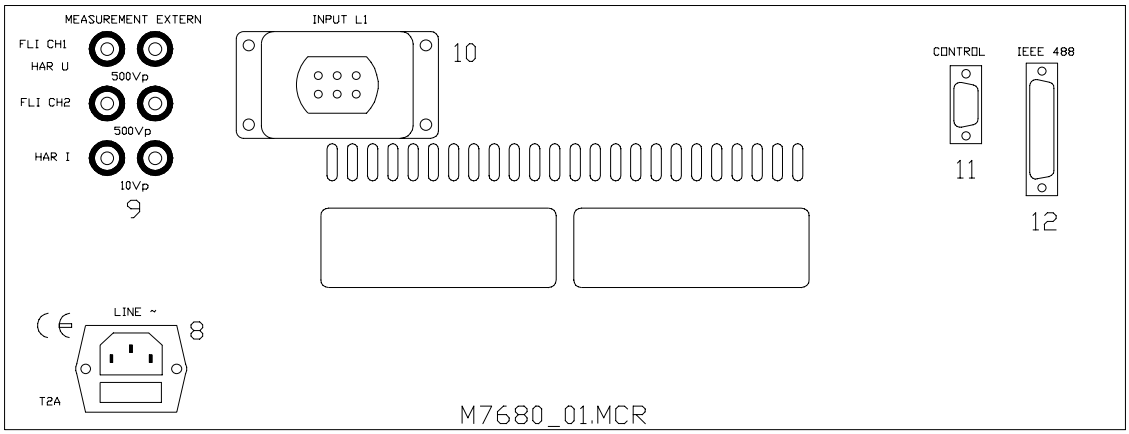
ARS 16/3



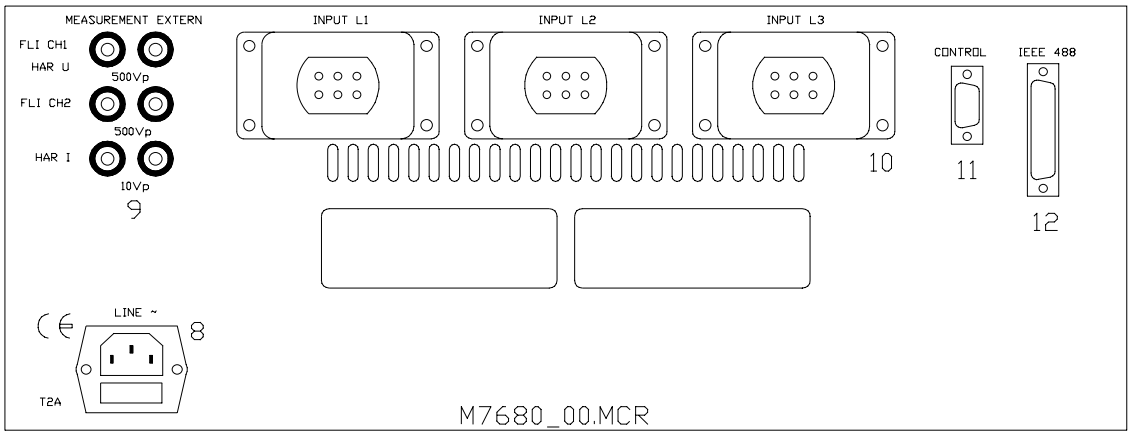
Pos.	Lettering	Function
1	POWER	Switch „POWER ON“
2		State indication via LED
3	MEASUREMENT	Measuring outputs „Analog Output“ (Flicker / Harmonics Analyser)
4	L1, N	Measuring output L1 for monitoring the output voltage
4	L1, L2, L3, N	Measuring output L1…L3 for monitoring the output voltage
5	OUTPUT	Single phase output
6		Circuit breaker (16A) overload protection
7	OUTPUT	Three-phase output

4.2. Rear Panel

ARS 16/1



ARS 16/3



Pos.	Lettering	Function
8	LINE~	Mains plug with fuse (T2A)
9	FLI CH1	Measurement input: Flickermeter channel 1 / voltage harmonics analyser
	FLI CH2	Measurement input: Flickermeter channel 2
	HAR	Measurement input: Harmonics current
10	INPUT L1	Power connection to the voltage source (single phase)
10	INPUT L1,L2,L3	Power connection to the voltage source (three phase)
11	CONTROL	Control: Additional impedance
12	IEEE 488	Remote control: IEEE-BUS

4.3. Description

The „Analyser Reference System“ (in the following referred to as „ARS“) contains the standard impedance according to IEC 725 as well as a phase- and current range switching. Combined with an analyser (Boconsult B10), it enables harmonic measurements according to EN 61000-3-2 and flicker measurements according to EN 61000-3-3.

To ensure fast and reasonable operation with the test system, flicker and harmonic measurements can be performed automatically one after another with the SPS-testing software. Thereby, the standard impedance switches uninterrupted between both measurement modes. In addition, the current ranges of the harmonic measurement are switched overlapping.

4.3.1. Operation

The ARS can only be controlled via IEEE-Bus.

The IEEE address is factory-adjusted: 3

Reference: This line impedance has been developed especially for the operation with an amplifier of the PAS-series. This type of amplifier is able to supply output voltages that could cause a damage of the line impedance (e.g. DC-voltage).

4.3.2. Status

The present measurement status is displayed at the LED’s „State“:

LED	**Meaning**
Error	see chapter „Error Messages“
R-Control	Indicates traffic via IEEE-bus
Overload	Current measuring range is exceeded
PLL	PLL for the harmonic measurement engaged
No Sig. CH1	No voltage at measurement input CH1
No Sig. CH2	No voltage at measurement input CH2
Autorange	Automatic range selection
Extern	The rear inputs are used for the measurements

4.3.3. Operation Mode

The present operation mode is displayed at the LED's „Mode":

LED	Meaning
Direct	The input of the ARS is switched directly to the output.
Flicker	The impedance is switched between input and output. ⇒ Flicker measurement according to EN 61000-3-3
Harmonics	Impedance short-circuited; the current of the selected phase flows over the current measurement. ⇒ harmonic measurement according to EN 61000-3-2
Harmonics+Imp	Harmonic measurement inclusive impedance (e.g. for the Japanese market)

4.3.4. Phase

The present measurement phase is displayed at the LED's „Phase":

LED	Meaning
L1	Voltage measurement between L1 and N
L2	Voltage measurement between L2 and N
L3	Voltage measurement between L3 and N
N	Voltage measurement between L1 and N, current measurement in neutral conductor (only at harmonic measurement)

With single-phase ARS measurement is only possible between L1 and N. Phase switching via IEEE 488 interface are not executed.

Additionally to the voltage measurement the selected phase is switched to the analyser (B10) at operation mode „HARMONICS".

4.3.5. Range

The selected current range for the harmonic measurement is displayed at the LED's „Range".

LED	Meaning
0.16A	Range 0.16A
0.8A	Range 0.8A
4A	Range 4A
20A	Range 20A
80A	Range 80A (only possible in connection with internal impedance)
250A	Range 250A (only possible in connection with internal impedance)

4.3.6. Measuring Outputs

The output voltage can be measured at the measuring outputs „N, L1, L2 ,L3“ at the front panel of the ARS. The measurement outputs are protected against short-circuit with cold resistance.

The internal resistance is approx. 100Ω.

At the front panel of the ARS there are also the measurement outputs „A“ and „B“ for the phases L1, L2 and L3. At these outputs are analogue outputs which can be programmed with various functions.

4.3.7. Sense Lines

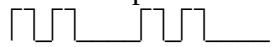
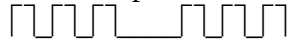
The ARS is provided with a sense line for each phase. By means of these lines the contacts and supply conductor resistors of the voltage source (e.g. amplifier type PAS) to the line impedance are compensated.

4.3.8. Current Ranges

The current ranges for the harmonic measurement are protected against overload. Generally, each phase of the line impedance is protected with the 16A-fuse.

4.3.9. Error Messages

Various error messages are indicated with the LED „ERROR“.

LED	**Error**
Flashes in 1sec cycle 	Internal address error at the I2C-Bus. ARS gets locked and can only be re-activated by means of switching off or on.
2xflash - pause 	Wrong command. An inadmissible command has been selected via the remote control (e.g. current range).
3xflash - pause 	Internal communication error at the I2C-Bus. ARS gets locked and can only be re-activated by means of switching off or on.

4.3.10. External Inputs

Via the measurement inputs „FLI CH1“, „FLI CH2“ and „HAR I“ at the rear of the ARS, an external measuring signal (e.g. from a further line impedance) can be supplied to the analyser unit of the ARS.

Via a specific command the ARS can be connected to the external measurement mode (LED „Extern“ lights).

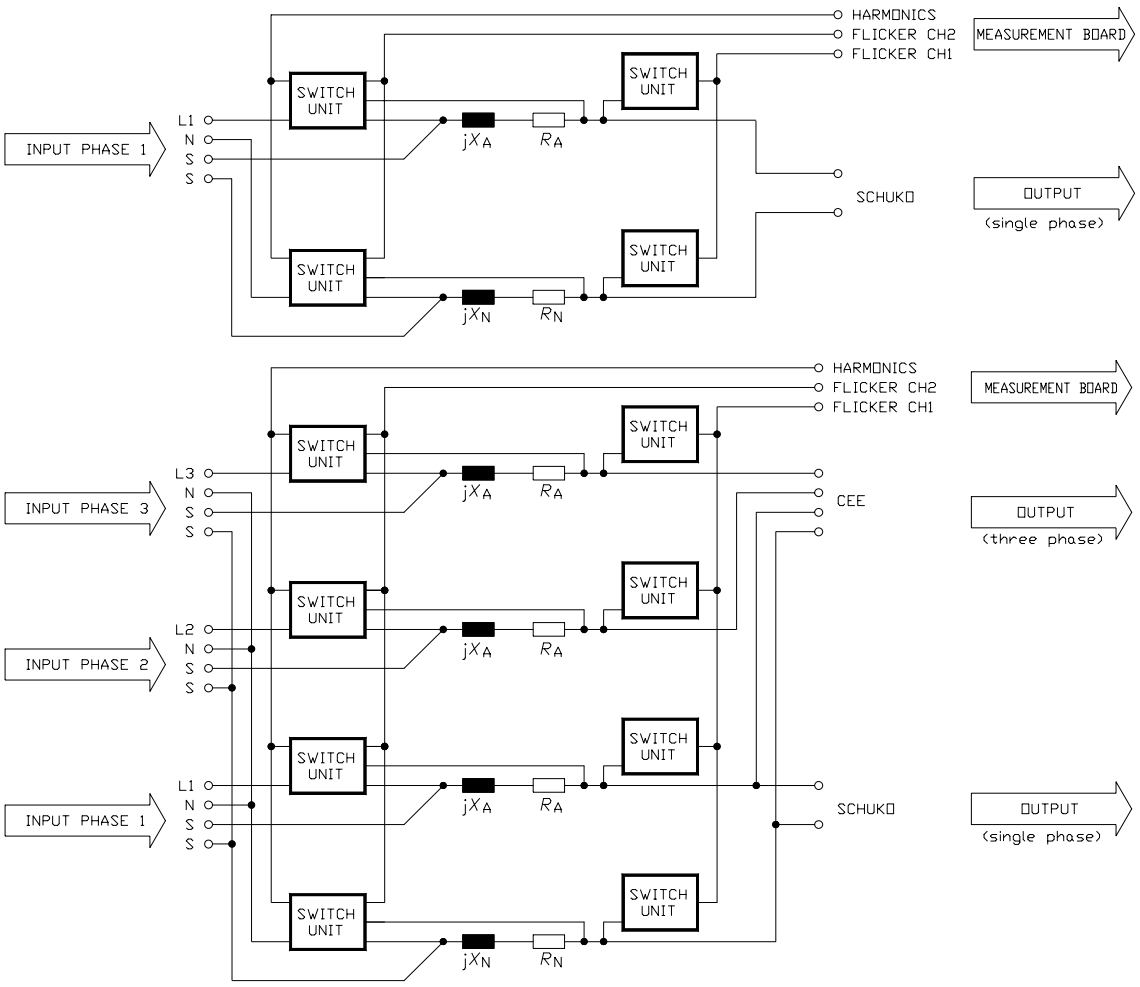
FLI CH1 Measurement input for the voltage of the test specimen (Flicker / harmonics)

FLI CH2 Measurement input for the source voltage (Flicker)

HAR I Measurement input for the current of the test specimen (harmonics)
$3V_{rms}$ correspond to the upper limit of the current range

Electrical specifications of the inputs see chapter „Technical Data“.

4.3.11. Block Diagram



R_A = 0.24Ω jX_A = 0.15Ω at 50Hz
R_N = 0.16Ω jX_N = 0.10Ω at 50Hz

4.4. Interface

4.4.1. IEEE 488

This section describes the installation of the IEEE module. IEEE 488 is a parallel 8 bit communication standard that enables the communication of the device with an external controller e.g. a computer or a terminal.

To each device a single IEEE address is assigned. The application of one address for two devices is not allowed.

The IEEE address is set to 3.

4.4.2. Command Syntax

The basic structure of a command is made up of the elements command, equal sign and argument. The commands are case insensitive.

Example: SET:IMPEDANCE=ON

SET:IMPEDANCE is the command, on is the argument. An equal sign has to be set between command and argument.

The capital letters of the command must be input, the lower case letters are optional.

Only single commands can be transferred.

The basic structure of a query is made up of a command (possibly also equal sign and argument) and a question mark.

Example: SET:IMPEDANCE?

When using IEEE interface the return value is available for transmission in an output puffer.

The device has a maximum input puffer with 256 characters. In this input puffer the transferred characters are stored until the command is executed. If more than 256 characters are fed the following characters are rejected until memory is available.

Default in on-position:

IMPEDANCE=L, SET_IMPEDANCE=OFF, H_I_RANGE=3 und PHASE=0.

Adjustments for

Direct-Mode:	H_I_RANGE=8,	SET_IMPEDANCE=OFF
Flicker-Mode:	H_I_RANGE=8,	SET_IMPEDANCE=ON
Harmonics-Mode:	H_I_RANGE={1|2|3|4|5|6},	SET_IMPEDANCE=OFF
Harmonics+Imp-Mode:	H_I_RANGE={1|2|3|4|5|6},	SET_IMPEDANCE=ON

In the following section all commands and queries for the device are listed.

The following notation is used for the description of the command syntax:

Symbol	**Meaning**
< >	Defined element
{ }	Group, one element is required
[ ]	Optional, can be omitted
|	Exclusive Or
...	Previous element(s) may be repeated

Examples:
H_I_RANGE=<INT>
IMPEDANCE={L|H}

4.4.3. List of Commands

Impedance:

Description	Command	Section
Adjustment power arm	IMPEDANCE	4.4.4
Impedance on/off	SET_IMPEDANCE	4.4.5
Adjustment current measurement range	H_I_RANGE	4.4.6
Adjustment phases	PHASE	4.4.7

Interface:

Description	Command	Section
Query identification of the device	*IDN?	4.4.8

4.4.4. IMPEDANCE

With this command the power arm can be adjusted. You can select between power flow via ARS or via AIP.

Default

IMPEDANCE=L

Group

Impedance

Syntax

IMPEDANCE={L|H}

IMPEDANCE?

Arguments

L	Power flow via ARS
H	Power flow via AIP

Examples

`IMPEDANCE=L`	`Selects power flow via ARS.`
`IMPEDANCE?`	`States whether the power flow is adjusted for ARS {IMPEDANCE=L} or AIP {IMPEDANCE=H}.`

4.4.5. SET_IMPEDANCE

With this command the adjusted impedance can be switched on and/or off.

Default
SET_IMPEDANCE=OFF

Group
Impedance

Syntax

SET_IMPEDANCE={ON|OFF}

SET_IMPEDANCE?

Arguments

ON	Switching on the adjusted impedance
OFF	Switching off the adjusted impedance

Examples

`SET_IMPEDANCE=ON`	`Switches on the adjusted impedance.`
`SET_IMPEDANCE?`	`States whether the impedance is switched on {SET_IMPEDANCE=ON} or off {SET_IMPEDANCE=OFF}.`

4.4.6. H_I_RANGE

With this command the current measurement range can be adjusted.

Default

H_I_RANGE=3

Group

Impedance

Syntax

H_I_RANGE={1|2|3|4|5|6|8}

H_I_RANGE?

Arguments

1	250A measuring range (AIP required, optional)
2	80A measuring range (AIP required, optional)
3	20A measuring range
4	4A measuring range
5	0.8A measuring range
6	0.16A measuring range
7	reserved (not implemented)
8	Switching off shunt

Examples

`H_I_RANGE=6`	`Selects the 0.16A current measurement range.`
`H_I_RANGE?`	`States which current measurement range is selected {H_I_RANGE=1 S4 | H_I_RANGE=2 S4 | H_I_RANGE=3 S4 | H_I_RANGE=4 S4 | H_I_RANGE=5 S4 | H_I_RANGE=6 S4 | H_I_RANGE=8 S4}.`

Reference: The annex S4 means shunt type 4 (internal relevance).

4.4.7. PHASE

With this command the measurement phase(s) can be adjusted. The measurement phase(s) is/are that phase(s) where voltage and/or current is/are measured.

Default

PHASE=0

Group

Impedance

Syntax

PHASE={0|1|2|3}

PHASE?

Arguments

ARS16/x:

0	Select N for measurement phase
1	Select L1 for measurement phase
2	Select L2 for measurement phase
3	Select L3 for measurement phase

ARS16/3/TPM:

0	Select N for measurement phase
1	Select L1 for measurement phase
2	Select L1 L2 and N for measurement phase (from Firmware: Axx24T_32.HEX)
3	Select L1 L2 and L3 for measurement phase

Examples

`PHASE=1`	`Selects L1 for measurement phase.`
`PHASE?`	`Returns the selected measurement phase(s).`

*4.4.8. *IDN? (only query)*

With this command the identification of the device (device type, version number)can be queried.

Group

Interface

Syntax

***IDN?**

Return

<STRING> The string returns the identification of the device.

4.5. Technical Data

Input voltage:	Harmonic:	AC:	90V ... 300V
		DC:	0V ... 48V (1)
	Flicker:	AC:	40V ... 504V (auto ranging)
		DC:	0V ... 48V (1)
Input frequency:	45Hz … 65Hz		
Continuous current:	$16A_{rms}$		
Short time current:	max. $32A_{rms}$		
Internal resistance:	Phase conductor R + jX = (0.24Ω+j0.15Ω) at 50Hz Neutral conductor R + jX = (0.16Ω+j0.10Ω) at 50Hz Phase-neutral conductor R + jX = (0.40Ω+j0.25Ω) at 50Hz		
Measurement accuracy:	annual calibration cycle		
Harmonics measurement:			
Fundamental U:	0,2% of measured value		
Fundamental I:	0,2% of measured value plus		
Harmonic:	Measuring range 20A ±8,0mA Measuring range 4A ±1,6mA Measuring range 0,8A ±0,32mA Measuring range 0.16A ±0,20mA		
Flicker measurement:			
Pst:	±5% relating to Pst = 1		
d-values:	0,2% Un		
Additional measuring inputs:	FLI CH1 $0V_{ac}$ ... $300V_{ac}$ FLI CH2 $0V_{ac}$ … $300V_{ac}$ HAR I $0V_p$ … $10V_p$ (2)		
Mains supply:	$230V_{rms}$ (+6% -10%) 50/60Hz, 2A		
Ambient temperature:	0°C up to +40°C		
Housing:	19“-plug-in unit (4U), colour light grey (RAL7035) approx. H=178mm; W=483mm; D=450mm		
Weight:	approx. 21kg		

(1) At DC-voltages >48V switching on/off and changing the operation mode **must be conducted off load !**

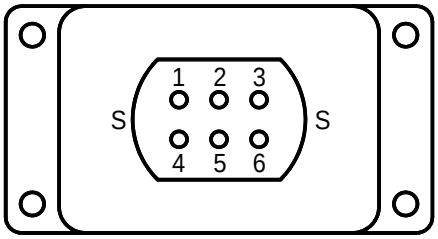
(2) $3V_{rms}$ correspond the upper range value of the current range.

4.6. Technical Information

4.6.1. Pin Assignment

Pin assignment „INPUT L1 (L2, L3)“ (10)

Pin	Assignment
1	Sense line: +Potential
2	Supply voltage: +Potential
3	Supply voltage: +Potential
4	Supply voltage: -Potential (GND)
5	Supply voltage: -Potential (GND)
6	Sense line: -Potential
S	Protective conductor (PE)



Pin assignment „CONTROL“ (11)

Pin	Labelling	Assignment	
1	PH0	00	Neutral
		01	L1
		10	L2
		11	L3
2	RA0	000	250A
		001	80A
		010	20A
		011	4A
		100	0.8A
		101	0.16A
		110	unused
		111	No Shunt
3	RA2	see RA0	
4	IM	0	Impedance Off
		1	Impedance On
5	GND	GND	
6	PH1	see PH0	
7	RA1	see RA0	
8	RES	Reserve	
9	EXT	0	Intern
		1	Extern

Pin assignment „IEEE 488“ (12)

Pin	Assignment
1	DIO1
2	DIO2
3	DIO3
4	DIO4
5	EOI (end or identify)
6	DAV (data valid)
7	NRFD (not ready for data)
8	NDAC (not data accepted)
9	IFC (interface clear)
10	SRQ (service request)
11	ATN (attention)
12	SHIELD
13	DIO5
14	DIO6
15	DIO7
16	DIO8
17	REN (remote enable)
18	GND (TW PAIR W/DAV)
19	GND (TW PAIR W/NRFD)
20	GND (TW PAIR W/NDAC)
21	GND (TW PAIR W/IFC)
22	GND (TW PAIR W/SRQ)
23	GND (TW PAIR W/ATN)
24	SIGNAL GROUND